

the conclusion that the molecular weights of the polymers remain essentially unchanged.

Applicants accept the conclusion that the molecular weights of the polymers remain **substantially unchanged** during the hydroxyalkylation process according to the present invention, as shown clearly on pages 9 and 12 of the specification, which has been referred to by the Examiner on page 3 of the present Office Action as follows: "...the specification at pages 9 and 12 cited by the applicant clearly contemplate the molecular weights being the same," and follows it by alleging that the applicants have not shown that the hydroxyalkylation process according to the present invention can be carried out without substantially increasing the molecular weight.

Applicants point out that the molecular weights of the commercial CTBN, which is the starting materials provided by the manufacturer, have molecular weights of 3,800 provided by the manufacturer and are measured by the old and generally not very reliable method of **Vapor Pressure Osmometry (VPO)** (see page 20, lines 1-5, of the present specification).

In contrast, the molecular weights of the HTBN's of Examples 10 and 11, which are the products of the hydroxyalkylation process according to the present invention, were measured using a more modern and the more reliable method of **Size Exclusion Chromatography**, using a **polystyrene standard** to calibrate the system. The molecular weights of the HTBN's of Examples 10 and 11, are Number Average Molecular Weights, which are compared with the Number Average Molecular Weight of commercial HTBN, also determined by the applicants using Size Exclusion Chromatography, with polystyrene standard (see pages 26-27, of the present specification).

Thus, the two methods described above do not produce the same numbers for the measured molecular weights. However, the comparison was used to indicate

that Molecular Weight of the products of the hydroxyalkylation process according to the present invention, were comparable to that of the commercial HTBN provided by the manufacturer (see pages 26-27, of the present specification).

On the other hand, the fact that the HTBN products are not substantially higher in MW than their precursor, CTBN, can be verified by comparing the acid number of CTBN with hydroxyl and acid numbers of HTBN.

Applicants have cancelled claim 44 and have amended claim 43 to indicate that dihydroxyl-functionalized material has a molecular weight that is **substantially unchanged** relative to the molecular weight of said dicarboxylic acid-functionalized starting material, as it has been shown clearly on pages 9 and 12 of the specification and concluded by the Examiner on page 3 of the present Office Action by the statement that "...the specification at pages 9 and 12 cited by the applicant clearly contemplate the molecular weights being the same," which concedes that the applicants have indeed shown that the hydroxyalkylation process according to the present invention can be carried out without substantially increasing the molecular weight.

Claim 26 is rejected under 35 U.S.C. §112, second paragraph, as being indefinite because of lack of antecedent basis for "and combinations thereof" in claim 23.

Applicants have amended claim 23 to provide an antecedent basis for combinations of the carbocyclic carbonate and carbocyclic sulfites. Support for "combinations thereof" is found in the cancelled claim 3, as originally filed.

Claim 26 is further rejected under 35 U.S.C. §112, fourth paragraph, for "not further specifying a limitation of the subject matter in the parent claim."

Applicants have amended claim 26 to further specify a limitation of the subject matter in the parent claim to "carbocyclic carbonate or carbocyclic sulfites."

Claims 23-28, 31 34-37 and 43-44 are rejected under 35 U.S.C. §103(a) as being allegedly obvious over Okamoto in view of alleged admissions of applicant, Merck Index, Wu and/or Yoshino, in further view of Wu or Yoshino.

The above 35 U.S.C. §103(a) rejection in the present Office Action is an "omnibus" rejection is improper because the combination of the references relied upon for the rejection is unclear, confusing and in part meaningless.

Okamoto	<u>in view of</u>	Admissions	<u>in further view of</u>	Wu
		by Applicant		<u>or</u>
		Merck Index		Yoshino
		Wu		
		<u>and/or</u>		
		Yoshino		

The 35 U.S.C. §103(a) rejection based on above combination of references requires "Wu" to be "in further view of" itself. Further, the combination requires "Yoshino" to be "in further view of" itself. Still further, even if one assumes that what is intended is "or" instead of "and," the 35 U.S.C. §103(a) rejection would still require "Wu" to be "in further view of" itself as well as "Yoshino" to be "in further view of" itself.

Accordingly, the rejection of claims 23-28, 31, 34-37 and 43-44 under 35 U.S.C. §103(a) as allegedly being obvious over Okamoto in view of alleged admissions, Merck Index, Wu and/or Yoshino, in further view of Wu or Yoshino is unclear, confusing and in part meaningless, and thus, improper.

Accordingly, Applicants submit that this "omnibus" rejection should be withdrawn and clearly stated rejections detailing what basis of each rejection should be provided. A mere change of "and" "and/or" does not clarify the previously applied "omnibus" rejection, but rather it makes it even more vague, confusing and in part meaningless, and thus, improper.

Applicants' arguments for the above "omnibus" rejection include the following:

The rejection relies upon alleged admissions found in the specification as its centerpiece to provide motivation to combine these disparate references. Thus, the so-called admissions alleged by the present Office Action appears to be based on a statement of advantages of the present invention over the methods of the prior art.

The present application states that ethylene carbonate, which is the reagent employed as the hydroxylating agent in the present invention, has the advantage of being a low toxicity reagent relative to ethylene oxide, which has relatively high toxicity. The Office Action goes on to conclude, incorrectly in our view, that a person of ordinary skill in the art would have sufficient **motivation to combine** the cited references to arrive at the process defined by the instant claims.

Applicant points out that recognition of an advantage, which typically occurs either concurrent with or post-invention, does not provide a person of ordinary skill in the art motivation to modify one or more references to achieve that advantage. The instant claims are rejected as being obvious over an "advantage" described in the present application, with a requirement to combine that advantage with four additional references. None of the four cited references teaches or suggests how to modify the various processes described in the remaining references to arrive at the process defined by the instant claims.

More specifically, there is no suggestion in any combination of the cited references that provide motivation for a person of ordinary skill in the art to replace ethylene oxide with ethylene carbonate and further replace a tertiary amine catalyst with a phase transfer catalyst.

To properly combine two or more references, there must be a teaching or a suggestion in each of the references to combine with each of the remaining references. This requirement of a teaching or a suggestion in each of the references to combine with each of the remaining references is referred to herein as a "cuncurrency requirement."

To suggest that Okamoto can be combined with alleged "admissions of applicant," Merck Index, Wu and/or Yoshino, and to further combine the resulting art with Wu or Yoshino, the Examiner is forced to utilized hindsight reconstruction to fashion a motivation to combine.

The Examiner offers nothing whatsoever from any of the five documents which would suggest or provide motivation to make a concurrent modification to incorporate the various teachings of the cited documents to arrive at the instantly claimed invention.

Concurrency is an important question in any obviousness rejection relying on more than two documents, as with the obviousness rejection based five different reference in any imaginable order without detailed analysis of the various combinations that the Examiner has applied in the present application. It is not proper to assert that one modification is rendered obvious by one combination of documents and then use the allegedly obvious "first sub-combination" as the basis for a second modification alleged to be suggested by a different document, to arrive at a "second sub-combination" and to proceed with this line of faulty "logic" over and over to finally combine five disparate references guided only by impermissible hindsight reconstruction. Combinations of properly combinable references are not

themselves prior art. Only a teaching or a suggestion in each of the references to combine with each of the remaining references can provide motivation to combine all five of the cited references.

A combination of a set of two references with another set of references cannot form the basis for a rejection without each reference teaching or modifying the remaining references in a manner that would produce the instantly claimed invention without hindsight reconstruction. Thus, for example, the alleged so called "admissions" by applicant that recognition of an advantage, which typically occurs either concurrent with or post-invention, does not provide a person of ordinary skill in the art motivation to modify one or more of the remaining four cited references to achieve that advantage.

The instant claims are rejected as being obvious over an "advantage" described in the present application, with a requirement to combine that advantage with four additional references, none of which teaches or suggests how to modify the various processes described in the remaining references to arrive at the process defined by the instant claims.

In the instant application, replacement of the ethylene oxide/tertiary amine catalyst by a carbocyclic carbonate/phase transfer catalyst in the process of Okamoto is not taught or suggested by any of the cited art.

Okamoto describes a process for preparing a hydroxyl-terminated polymer using: (i) ethylene oxide; and (ii) a tertiary amine catalyst.

The Office Action alleges that, because ethylene oxide is a hazardous material, it would be undesirable to use it as a reactant. This assumption is derived from the statement of advantages of the present invention over the methods of the prior art. It is not taught or suggested by any of the references.

Wu describes a process for preparing polyesters of polycarboxylic acids using a cyclic carbonate with a monomeric polyfunctional carboxylic acid in the presence of an alkylammonium halide catalyst. Yoshino describes preparation of a mixture of mono- and di-esters of ethylene glycol with a mono-carboxylic acid by the reaction of a monocarboxylic acid with ethylene carbonate in the presence of an alkylammonium halide catalyst.

The differences between the disclosures of these references and the invention defined by the instant claims is that Okamoto describes a process for preparing a hydroxyl-terminated polymer using ethylene oxide/tertiary amine catalyst combination but does not use carbocyclic carbonate/phase transfer catalyst combination whereas Wu uses a cyclic carbonate/ alkylammonium halide catalyst with a **monomeric** polyfunctional carboxylic acid, such as, terephthalic acid, as the starting material, to prepare **polyesters** but does not use a dicarboxylic acid-functionalized polymer of polybutadiene, poly(butadiene-co-acrylonitrile), poly(acrylonitrile) or a combination thereof to prepare a dihydroxyl-functionalized material. Yoshino uses ethylene carbonate/alkylammonium halide catalyst with a **mono**-carboxylic acid as the starting material to prepare a mixture of mono- and di-esters of ethylene glycol but, as in the case of Wu, does not use a dicarboxylic acid-functionalized polymer of polybutadiene, poly(butadiene-co-acrylonitrile), poly(acrylonitrile) or a combination thereof to prepare a dihydroxyl-functionalized material.

There is no teaching or suggestion in either Wu or Yoshino to use a dicarboxylic acid-functionalized polymer of polybutadiene, poly(butadiene-co-acrylonitrile), poly(acrylonitrile) or a combination thereof to prepare a dihydroxyl-functionalized material.

Conversely, there is no teaching or suggestion in Okamoto to replace ethylene oxide/tertiary amine catalyst combination with ethylene carbonate/phase transfer catalyst such as, alkylammonium halide.

There is no suggestion in Okamoto to replace the basic tertiary amine catalyst with a neutral phase transfer catalyst. There is no suggestion in either Wu or Yoshino that phase transfer catalysts and tertiary amine catalyst are equivalent or interchangeable. There is no suggestion in any of the references that the basic tertiary amine catalyst can be replaced with a neutral phase transfer catalyst, or *vice versa*, and obtain the same result. Further, Neither Wu nor Yoshino teach or suggest that the various starting materials used in either Wu or Yoshino could be replaced with a dicarboxylic acid-functionalized polymer of polybutadiene, poly(butadiene-co-acrylonitrile), poly(acrylonitrile) or a combination thereof to prepare a dihydroxyl-functionalized material.

A person of ordinary skill in the art would have to instinctively know how to pick and choose the right ingredients from one reference and simultaneously pick and choose the right ingredients from another reference to come up with the exact combination of ingredients to produce all the elements of the instant process. Thus, without a specific suggestion to modify the various teachings to obtain the claimed process of the present invention, Wu or Yoshino are not combinable with Okamoto.

Under the "concurrency requirement" as defined above, the combined teachings of the documents of record, therefore, must teach or suggest how to modify all of the references to provide proper motivation for a person of ordinary skill in the art to perform all of the required modifications at the same time, not merely individually. In other words, there should be a road map in the cited references regarding how a person of ordinary skill in the art can arrive at the instantly claimed invention.

Concurrent modifications may often be unsuccessful, even when individual modifications succeed. The concurrent modifications may interfere with the relevant properties sought by the individual modifications, and may even detract from the

properties of the starting formulations. Thus, a person of ordinary skill in the art would not have "a reasonable expectation of success" in obtaining the improved properties unless the concurrent modification is specifically suggested.

Nothing in any of the documents cited by the Examiner sheds light on the concurrency question and the Examiner has not even attempted to answer why a person of ordinary skill in the art would want to make such modifications concurrently. Without a reasonable expectation of success in the concurrent modification of Okamoto combined with alleged "admissions of applicant," Merck Index, Wu and/or Yoshino, the claimed invention cannot possibly be obvious.

Without such a teaching or a suggestion, a person of ordinary skill in the art would not be motivated to combine five references. Even if all the elements of a claim are described in separate references, there has to be provided a teaching or a suggestion in the references to provide motivation for a person of ordinary skill in the art to combine the references in question. Thus, a showing of motivation is one of the essential requirements that must be met to establish a *prima facie* case of obviousness.

Further, none of the cited references teach or suggest to select various elements from a large number of references and combine them in a manner that provides a reasonable expectation of success in producing a process according to the present invention. In addition, none of the cited references teach or suggest the desirability of replacing the ethylene oxide/tertiary amine catalyst in one reference by a carbocyclic carbonate/phase transfer catalyst of another with a reasonable expectation of success.

Thus, in the absence of a teaching or a suggestion of the desirability of such a replacement, the cited references alone or in combination do not render the claims of the instant invention obvious.

Regarding the toxicity of ethylene oxide and that nearly all chemicals used in the chemical industry, including ethylene oxide, are toxic to one degree or another to humans, animals and the environment and despite this, millions of pounds of ethylene oxide are produced annually by the chemical industry.

Thus, a person of ordinary skill in the art would not be motivated to look for a replacement for ethylene oxide simply because of its toxicity. The mere fact that a chemical is hazardous is not, in and of itself, a suggestion to replace ethylene oxide with another chemical, particularly in the present case, because ethylene oxide is an inexpensive hydroxyalkylating agent. The “added cost to provide the necessary safety and protection” argument advanced by the Examiner is not persuasive because ethylene oxide is so inexpensive that safety costs would not be sufficient to offset the higher cost of alternative reagents. Accordingly, Applicant points out that the recognition of the advantages of the present invention does not fulfill the necessary motivation requirement to look for alternatives or to combine Okamoto with Wu or Yoshino.

In support for the above, Applicant has submitted a Declaration under 37 C.F.R. § 1.132 in response to the multi-reference rejections to show that a person of ordinary skill in the art would not be motivated to replace ethylene oxide with ethylene carbonate.

More specifically, the Declaration states that nearly all chemicals used in the chemical industry, including ethylene oxide, are toxic to one degree or another. Despite this, millions of pounds of ethylene oxide are produced and used annually by the chemical industry. Thus, one would not automatically replace ethylene oxide for being hazardous. As mentioned above, ethylene and propylene oxides are so inexpensive that any added safety costs associated with their use would be insufficient to offset the higher cost of ethylene and propylene carbonates and thus, would not provide sufficient motivation to replace ethylene oxide with ethylene carbonate.

In addition, the molecular weight of ethylene carbonate is twice the molecular weight of ethylene oxide. In the hydroxyalkylation of a carboxyfunctional material using ethylene oxide as the hydroxyalkylating agent, 100% of the weight of the ethylene oxide would be added to the carboxyfunctional material, so that all of the hydroxyalkylating agent is retained in the reaction product without any loss of material.

In sharp contrast, in the hydroxyalkylation of a carboxyfunctional material using ethylene carbonate as the hydroxyalkylating agent, only 50% of the weight of the ethylene carbonate is added to the carboxyfunctional material. The remaining 50% is lost as CO_2 , a by-product that requires disposal. Thus, the 50% weight loss and doubling the raw material cost would quadruple the raw material costs, so that a person of ordinary skill in the art would not have motivation to replace ethylene oxide with ethylene carbonate.

The Office Action refers to the high cost of ethylene oxide available from Aldrich Chemical, Inc.

Applicant points out that chemical plants that use ethylene oxide do not purchase this chemical from Aldrich, which provides ethylene oxide as a "research" chemical in small cylinders, not as a chemical in industrial scale quantities available at more favorable pricing. Accordingly, the reference to the high cost of ethylene oxide from Aldrich is not relevant to the issue of motivation.

As mentioned previously, the toxicity of a chemical alone is insufficient to provide the requisite motivation, which is missing in the above-cited references, to replace ethylene oxide with ethylene carbonate and further replace the tertiary amine catalyst with a phase transfer catalyst and still further, replace the various carboxylic acid starting materials with a dicarboxylic acid-functionalized polymer of

polybutadiene, poly(butadiene-co-acrylonitrile), poly(acrylonitrile) or a combination thereof to prepare a dihydroxyl-functionalized material.

Controlling the molecular weight of the hydroxyalkylated final product is advantageous for producing a useful hydroxyalkylated final product. The process according to the present invention provides means for controlling the molecular weight of the hydroxyalkylated final product produced and, as a result, avoids extensive resin extension. This is an unexpected result not taught or suggested by any of the cited references.

The absence of excessive resin extension in the dihydroxyl-functionalized material, is an important aspect of the present invention because low fusible-materials and block prepolymer resins prepared from HTBNs and organic diisocyanates are constrained by the permissible molecular weights of the reactants to achieve appropriate physical properties in the final product. High molecular weight materials would not be useful in the compositions of the present invention. Thus, claim 43, as amended, incorporates this surprising and unexpected characterization so that claim 43 is allowable at least for this reason alone.

Claim 25 rejected under 35 U.S.C. §103(a) as being allegedly obvious over Okamoto in view of alleged admissions of applicant, Merck Index, Wu and Yoshino, in further view of Wu or Yoshino and further in view of admissions by applicant.

As shown above for the first 35 U.S.C. §103(a) rejection, this rejection is not proper for the same reasons, i.e., for being an "omnibus" rejection that is further compounded by having a "further in view of admissions by applicant."

Claim 25 is a dependent claim depending from claim 23. Applicants have provided amendments and arguments, which place claim 23 in condition for allowance. Claim 25 merely limits the dicarboxylic acid-functionalized starting material to polymers that have a number average molecular weight of from about

3,100 to about 4,200. Accordingly, claim 25 is also allowable by virtue of its dependency from claim 23.

To properly combine two or more references, **there must be a teaching or a suggestion in each of the references to combine**. Without such a teaching or a suggestion, a person of ordinary skill in the art would not be motivated to combine two or more references.

Even if all the elements of a claim are described in separate references, there has to be provided a teaching or a suggestion in the references to provide motivation for a person of ordinary skill in the art to combine the references in question. Thus, a showing of motivation is one of the essential requirements that must be met to establish a *prima facie* case of obviousness (see MPEP § 2142 and *In re Rouffet*, 47 USPQ 2d at 1457-1458).

Absent such a teaching or suggestion to provide motivation to combine, the cited references are not properly combinable because a person of ordinary skill in the art would not be able to arrive at the claimed invention except through either extensive experimentation or impermissible hindsight.

None of the cited references teach or suggest to select various elements from a large number of references and combine them **in a manner that provides a reasonable expectation of success consistent with the concurrency requirement defined above**, in producing a process according to the present invention. In addition, none of the cited references teach or suggest the desirability of replacing the ethylene oxide/tertiary amine catalyst in one reference by a carbocyclic carbonate/phase transfer catalyst of another with a reasonable expectation of success.

In the absence of a teaching or a suggestion of the desirability of such a replacement, the cited references alone or in combination do not render the claims of

the instant invention obvious (see MPEP 2143.01). Thus, the criteria for establishing a *prima facie* case of obviousness have not been met (see MPEP 2143, citing *In Re Vaeck*, 947 F.2d 488, 20 USPQ 2d 1438 (Fed. Cir. 1991)).

Based on the foregoing, withdrawal of the Rejections of pending claims is requested and indication of their allowability is respectfully solicited.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

This application was amended as follows:

IN THE CLAIMS

Claim 44 was canceled without prejudice.

The claims were amended as follows:

23. (Twice Amended) A process for preparing a dihydroxyl-functionalized material by hydroxyalkylating a dicarboxylic acid-functionalized material, said process comprising the step of: reacting as reactants: (a) a dicarboxylic acid-functionalized material selected from the group consisting of dicarboxylic acid-functionalized polymers of: polybutadiene, poly(butadiene-co-acrylonitrile), poly(acrylonitrile) and combinations thereof; and (b) a hydroxyalkylating reagent selected from the group consisting of: a carbocyclic carbonate, [and] a carbocyclic sulfite and combinations thereof; in the presence of: (c) a phase transfer catalyst under conditions sufficient to form a dihydroxyl-functionalized material.

26. (Amended) The process according to claim 23, wherein said hydroxyalkylating reactant is a member selected from the group consisting of carbocyclic carbonate[,], and carbocyclic sulfites [and combinations thereof].

43. (Amended) The process according to claim 23, wherein said dihydroxyl-functionalized material has a [number average] molecular weight [of up to about three times greater than] that is substantially unchanged relative to the molecular weight of said dicarboxylic acid-functionalized starting material.